

AMENDMENTS TO THE CLAIMS AND LISTING OF CLAIMS

1. (Presently Amended) A flame detector circuit comprising:
 - a UV flame sensor tube having a cathode and an anode;
 - a non-pulsed DC supply;
 - a cathode/anode circuit, including a quench circuit, series connecting the cathode and anode of the UV tube with said DC supply, a desired pulse signal being generated in said cathode/anode circuit by action of the quench circuit in the presence of a burner flame and undesired pulse signals being generated in said cathode/anode circuit by action of the quench circuit if said UV tube is contaminated or in the absence of a burner flame; and
 - a discriminator circuit responsive to the pulse signal in said cathode/anode circuit for distinguishing between ~~the~~ a desired flame responsive pulse signal and ~~the~~ an undesired pulse signal to generate an output signal.
2. (Original) The flame detector of claim 1 in a burner fuel valve control, including an output circuit which opens said fuel valve in response to said desired pulse signal.
3. (Original) The flame detector of claim 1 in a burner fuel valve control, including an output circuit which closes said fuel valve in response to said undesired pulse signal.
4. (Canceled)

5. (Presently Amended) The flame detector of claim 4 1 wherein the desired pulse signal has ~~an~~ a selected intermediate frequency, the undesired pulse signals have a high frequency if UV tube is contaminated and a low frequency in the absence of a flame, and the discriminator circuit passes the intermediate frequency pulse signal to generate said output signal and rejects the high and low frequency pulse signals.

6. (Canceled)

7. (Canceled)

8. (Presently Amended) The flame detector of claim 7 40 in which said flame simulator is a charge pump including a transformer with a flyback circuit responsive to said intermediate frequency pulse signal to generate said flame rod current.

9. (Canceled)

10. (Presently Amended) The ~~flame detector~~ lockout circuit of claim 9 ~~in~~ 41 which ~~said lockout circuit~~ is responsive to an abnormal condition of the UV tube cathode/anode circuit.

11. (Presently Amended) The ~~flame detector~~ lockout circuit of claim 9 ~~in~~ 41 which ~~said lockout circuit~~ is responsive to the ~~undesired pulse signal~~ output signal generated if in response

to the undesired pulse signal when said UV tube is contaminated.

12. (Presently Amended) The ~~flame detector~~ lockout circuit of claim 10 in which the ~~lockout circuit~~ is responsive to a short circuit of the UV tube.

13. (Presently Amended) The ~~flame detector~~ lockout circuit of claim 10 in which said ~~lockout circuit~~ is responsive to a short circuit of the quench circuit.

14. (Presently Amended) The ~~flame detector~~ lockout circuit of claim 10 in which said ~~lockout circuit~~ is responsive to a short circuit of the UV tube cathode/anode circuit.

15. (Presently Amended) The ~~flame detector~~ lockout circuit of claim 9 ~~41~~ in which said ~~lockout circuit~~ is responsive to electrical noise.

16. (Presently Amended) The ~~flame detector~~ lockout circuit of claim 9 ~~41~~ in which said ~~lockout circuit~~ is responsive to a condition energizing the fuel valve in the absence of a flame responsive signal, to close the fuel valve.

17. (Presently Amended) The ~~flame detector~~ lockout circuit of claim ~~16~~ 41 including a time delay to prevent closing the fuel valve with a temporary loss of the flame responsive signal.

18. (Canceled)

19. (Canceled)

20. (Canceled)

21. (Canceled)

22. (Presently Amended) The flame detector of claim ~~9~~ 41 further comprising a DC voltage supply for said discriminator circuit and a circuit responsive to operation of said lockout circuit for reducing the voltage of said DC voltage supply to disable said discriminator circuit upon operation of said lockout circuit.

23. (Canceled)

24. (Presently Amended) The flame detector of claim ~~23~~ 45 in which said buffer circuit comprises an optocoupler.

25. (Canceled)

26. (Canceled)

27. (Canceled)

28. (Presently Amended) A flame detector circuit, comprising:

a UV flame sensor tube having a cathode and an anode;

a non-pulsed DC supply; and

a cathode/anode circuit including a parallel resistor-capacitor quench circuit series connecting the UV tube with the DC supply.

29. (Presently Amended) The flame detector circuit of claim 28 further comprising a load element in said ~~anode/cathode~~ cathode/anode circuit for developing a pulse signal in response to detection of a flame.

30. (Presently Amended) In a flame detector circuit having a UV flame sensor tube with a cathode and an anode, a DC supply, a cathode/anode circuit, including a quench circuit, connecting the cathode and anode of the UV tube with said DC supply, a desired pulse signal being generated in said cathode/anode circuit by action of the quench circuit in the presence of a flame and undesired pulse signals being generated in said cathode/anode circuit by action of the quench circuit if the UV tube is contaminated or in the absence of a burner flame, the method of calibrating said detector circuit, comprising:

exposing said UV tube to a flame to generate a pulse signal at a frequency greater than ~~said~~ a selected frequency; and

attenuating the flame to which the tube is exposed to generate a desired pulse signal at said selected frequency.

31. (Presently Amended) The method of claim 30 in which ~~the~~ ultraviolet radiation from the flame is attenuated by placing a screen between the flame and the tube.

32. (Presently Amended) A flame detector comprising:
a UV gas discharge tube having anode and cathode electrodes;
a non-pulsed DC power supply;
a quench circuit series connected with the UV tube anode and cathode electrodes and said power supply.

33. (Canceled)

34. (Canceled)

35. (Presently Amended) The flame detector of claim 32 in which said quench circuit includes a capacitor, said tube is located adjacent a flame and said DC power supply and quench an LED coupling circuit is are remote therefrom.

36. (Original) The flame detector of claim 24 wherein said optocoupler buffer circuit is

operated substantially at ground potential.

37. (Original) A flame detector circuit comprising:

a UV flame sensor tube having two identical electrodes;

a DC power supply;

a switching circuit connecting the UV electrodes and the quench circuit with the power supply, each UV tube electrode alternately having positive and negative charges and alternately serving as anode and cathode, a desired pulse signal being generated by action of the quench circuit in the presence of a burner flame, and undesired pulse signals being generated by action of the quench circuit if the UV tube is contaminated or in the absence of a burner flame, and

a discriminator circuit responsive to the pulse signal to distinguish between desired and undesired pulse signals.

38. (Presently Amended) The flame detector of claim 37 in which the switching circuit includes a double throw switch and an interval oscillator actuating the switch.

39. (New) A flame detector circuit comprising:

a UV flame sensor tube having a cathode and an anode;

a DC supply;

a cathode/anode circuit, including a quench circuit, connecting the cathode and anode of the UV tube with said DC supply, a desired pulse signal at a selected frequency being generated

in said cathode/anode circuit by action of the quench circuit in the presence of a burner flame and undesired pulse signals at other frequencies being generated in said cathode/anode circuit by action of the quench circuit if said UV tube is contaminated or in the absence of a burner flame; and

a frequency dependent charge pump discriminator circuit responsive to the pulse signal in said cathode/anode circuit for distinguishing between the desired flame responsive pulse signal and an undesired pulse signal to generate an output signal.

40. (New) A flame detector circuit in a burner fuel valve control comprising:

a UV flame sensor tube having a cathode and an anode;

a DC supply;

a cathode/anode circuit, including a quench circuit, connecting the cathode and anode of the UV tube with said DC supply, a desired pulse signal being generated in said cathode/anode circuit by action of the quench circuit in the presence of a burner flame and undesired pulse signals being generated in said cathode/anode circuit by action of the quench circuit if said UV tube is contaminated or in the absence of a burner flame;

a discriminator circuit responsive to the pulse signal in said cathode/anode circuit for distinguishing between the desired flame responsive pulse signal and an undesired pulse signal to generate an output signal; and

an output circuit comprising a combustion safeguard and a flame simulator responsive to the desired flame responsive pulse signal to generate a flame rod current, said combustion

safeguard being responsive to the flame rod current to operate said fuel valve.

41. (New) In a burner fuel valve control having
- a UV flame sensor tube with a cathode and anode,
 - a non-pulsed DC supply,
 - a cathode/anode circuit, including an RC quench circuit, connecting the cathode and anode of the UV tube with said DC supply, a desired pulse signal being generated in the cathode/anode circuit by action of the quench circuit in the presence of a burner flame and undesired pulse signals being generated in said cathode/anode circuit by action of the quench circuit if said UV tube is contaminated or in the absence of a burner flame,
 - a discriminator circuit responsive to the pulse signal in said cathode/anode circuit for distinguishing between a desired flame-responsive pulse signal and an undesired pulse signal, to generate an output signal, and
 - an output circuit responsive to said output signal to open said fuel valve in response to the output signal with said desired pulse signal and to close the fuel valve in response to the output signal with an undesired pulse signal, the improvement comprising:
 - a lockout circuit responsive to an abnormal condition of the flame detector circuit to close said fuel valve.

42. (New) The lockout circuit of claim 41 further comprising an SCR responsive to said abnormal condition of the flame detector circuit to conduct and actuate a relay to close said fuel

valve.

43. (New) A flame detector circuit comprising:

a UV flame sensor tube having a cathode and an anode;

a DC supply;

a cathode/anode circuit, including a quench circuit, connecting the cathode and anode of the UV tube with said DC supply, a desired pulse signal being generated in said cathode/anode circuit by action of the quench circuit in the presence of a burner flame and undesired pulse signals being generated in said cathode/anode circuit by action of the quench circuit if said UV tube is contaminated or in the absence of a burner flame;

a discriminator circuit responsive to the pulse signal in said cathode/anode circuit for distinguishing between the desired flame responsive pulse signal and an undesired pulse signal to generate an output signal; and

a circuit responsive to the desired pulse signal for periodically increasing the DC voltage applied to the UV sensor tube, increasing susceptibility of the UV sensor tube for contamination.

44. (New) A flame detector circuit comprising:

a UV flame sensor tube having a cathode and an anode;

a DC supply;

a cathode/anode circuit, including a quench circuit, connecting the cathode and anode of the UV tube with said DC supply, a desired pulse signal being generated in said cathode/anode

circuit by action of the quench circuit in the presence of a burner flame and undesired pulse signals being generated in said cathode/anode circuit by action of the quench circuit if said UV tube is contaminated or in the absence of a burner flame;

a discriminator circuit responsive to the pulse signal in said cathode/anode circuit for distinguishing between the desired flame responsive pulse signal and an undesired pulse signal to generate an output signal; and

a high voltage DC power supply for the UV tube anode/cathode circuit and a low voltage DC supply for the discriminator circuit, said high voltage DC supply having a minimum operating voltage, and a circuit for disabling the low voltage DC supply if the high voltage DC supply is less than said minimum.

45. (New) A flame detector circuit comprising:

a UV flame sensor tube having a cathode and an anode;

a DC supply;

a cathode/anode circuit, including a quench circuit, connecting the cathode and anode of the UV tube with said DC supply, a desired pulse signal being generated in said cathode/anode circuit by action of the quench circuit in the presence of a burner flame and undesired pulse signals being generated in said cathode/anode circuit by action of the quench circuit if said UV tube is contaminated or in the absence of a burner flame;

a discriminator circuit responsive to the pulse signal in said cathode/anode circuit for distinguishing between the desired flame responsive pulse signal and an undesired pulse signal to

generate an output signal; and

a buffer circuit between said UV tube cathode/anode circuit and said discriminator.

46. (New) A burner fuel valve control comprising:

a UV flame sensor tube having a cathode and an anode;

a DC supply;

a cathode/anode circuit, including a quench circuit, connecting the cathode and anode of the UV tube with said DC supply, a desired pulse signal being generated in said cathode/anode circuit by action of the quench circuit in the presence of a burner flame and undesired pulse signals being generated in said cathode/anode circuit by action of the quench circuit if said UV tube is contaminated or in the absence of a burner flame;

a discriminator circuit responsive to the pulse signal in said cathode/anode circuit for distinguishing between the desired flame responsive pulse signal and an undesired pulse signal to generate an output signal;

an output circuit which controls a fuel valve in accordance with the output signal of the discriminator circuit; and

an optocoupler between said discriminator circuit and said output circuit.

47. (New) A flame detector circuit comprising:

a UV flame sensor tube having a cathode and an anode;

a DC supply;

a cathode/anode circuit, including a quench circuit, connecting the cathode and anode of the UV tube with said DC supply, a desired pulse signal being generated in said cathode/anode circuit by action of the quench circuit in the presence of a burner flame and undesired pulse signals being generated in said cathode/anode circuit by action of the quench circuit if said UV tube is contaminated or in the absence of a burner flame;

a discriminator circuit responsive to the pulse signal in said cathode/anode circuit for distinguishing between the desired flame responsive pulse signal and an undesired pulse signal to generate an output signal the discriminator circuit including an optocoupler which is subject to electrical noise; and

an electrical noise detector which disables the discriminator circuit on the occurrence of electrical noise.